

REMARKS

Claims 1-20 and 36-46 are currently pending in the application. By this amendment, claims 11 and 19 are amended and claims 37-46 are added for the Examiner's consideration. The above amendments and added claims do not add new matter to the application and are fully supported by the original disclosure. For example, support for the amendments and added claims is provided in the claims as originally filed, at Figures 4 and 5, and at pages 11-12 and 15-18 of the specification. Reconsideration of the rejected claims in view of the above amendments and the following remarks is respectfully requested.

Drawings

Applicants appreciate the indication on the Office Action Summary dated August 3, 2006 that the drawings filed on March 20, 2002 are accepted.

35 U.S.C. §103 Rejection

Claims 1-6, 8-20, and 36 were rejected under 35 U.S.C. §103(a) for being unpatentable over U.S. Patent No. 6,757,645 issued to Chang *et al.* ("Chang") in view of U.S. Patent No. 6,873,720 issued to Cai *et al.* ("Cai"). Claim 7 was rejected under 35 U.S.C. §103(a) for being unpatentable over Chang in view of Cai and further in view of U.S. Patent No. 5,965,306 issued to Mansfield *et al.* ("Mansfield"). These rejections are respectfully traversed.

The Examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. To establish a *prima facie* case of obviousness, three

basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP §2142.

Claims 1-6, 8-20, and 36 in view of Chang and Cai

The present invention generally relates to the field of semiconductor manufacturing, and, more particularly, to a method for automating the evaluation and analysis of defects in masks used in the semiconductor manufacturing process to determine which defects would cause product failure. Exemplary non-limiting implementations of the invention provide for applying different acceptance rules to a defect depending upon the criticality of the defect. In this manner, the inspection process may be sped up by only applying more time-consuming critical acceptance rules to critical defects, while applying less time-consuming (i.e., less critical rules) rules to non-critical defects. Moreover, by applying different acceptance rules to different defects, fewer masks may be unnecessarily scrapped as failures. Independent claims 1, 11, 16, 19, and 36 all recite determining a final disposition of a component/mask by applying different acceptance rules to the critical defects and the non-critical defects. For example, claim 1 recites, *inter alia*:

determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects.

The applied references do not teach or suggest at least this feature. The Examiner, however, asserts that Chang discloses all of the features of the independent claims except for classifying the defects into critical defects and the non-critical defects based on the analyzing, and determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects. The Examiner is of the opinion that Cai teaches these features, and that it would have been obvious to modify Chang in view of Cai. Applicants respectfully disagree.

Chang discloses a mask inspection system. For example, the system of FIG. 9 operates to inspect a physical mask 905. The physical mask 905 is first inspected by the inspection tool 900 by scanning the physical mask 905 for possible defects. The defect area image generator 930 generates defect area images of those areas of the mask containing possible defects. The defect detection processor 925 receives design layout data 910 as an input. For each defect area image that is generated, the defect detection processor 925 operates to locate the corresponding area on the design layout data 910 and provide this information to input device 955. The defect area image generator 930 provides the defect area image data to the input device 945 of the stepper image generator 940 which processes the data. The mask image simulator 950 receives the processed image data from the input device 945, and generates a simulated mask stepper image 970. The simulated mask stepper image 970 and the simulated design stepper image 975 are provided to the image comparator 980 of the defect analyzer 990. The defect analyzer 990 includes a

computer implemented program that displays the images 970 and 975, and displays the differences between the two such that an operator can visually detect any differences. The operator then decides to accept, repair, or reject the mask (See, line 13 of column 20 though line 15 of col. 21).

As the Examiner admits, however, Chang does not teach or suggest classifying the defects into critical defects and the non-critical defects based on the analyzing, and determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects. Instead, as discussed above, Chang merely discloses that an operator looks at the images 970 and 975 to detect differences (i.e., defects).

Contrary to the Examiners assertions, Cai does not compensate for the deficiencies of Chang with respect to the claimed invention. That is, Cai does not teach or suggest determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects. Instead, Cai discloses the use of a single acceptance rule that applies to all defects. For example, Cai teaches that each individual defect has a numerical tolerance (TCD) associated with it based upon its location in the mask. Defects in more critical areas have a higher TCD value and defects in less critical areas have a lower TCD value. But regardless of the TCD value, each assigned TCD is a variable in an equation that produces a defect severity score (DSS). Based upon the DSS, the entire mask is either accepted, repaired, or scrapped (col. 5, lines 21-58; col. 13 – col. 18). Thus the DSS is an acceptance rule; whereas, the TCD, on the other hand, is a numerical measure of the criticality of a single defect. Thus, an individual defect is not accepted

or rejected based upon its TCD. Instead, all of the TCD's factor into the calculation of the DSS, which is the single acceptance rule for the mask. Therefore, Cai does not teach or suggest determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defect as recited in the claimed invention.

The Examiner is of the opinion that Cai teaches applying different acceptance rules to critical and non-critical defects in lines 48-50 of column 9. Applicants disagree. Cai recognizes that a general rule limited only to the spacing of features does not provide an accurate indication of printability impact because some defects are more substantial than others due to their location in a critical or non-critical region (col. 9, lines 1-8). Cai further discloses that

One possible solution to this problem is to measure the distances to neighboring features (such as d1, d2, and d3) from each defect (such as defects 401, 402, and 403, respectively). These distances in combination with a measurement of the size of the defect could be factored into a plurality of design rules to provide the printability impact. However, this analysis is computationally intensive, thereby increasing the time required to provide meaningful information to the customer. Moreover, even if the size of the defect and the distance of the defect from the neighboring feature are known, the actual impact of the defect on the neighboring feature cannot fully be predicted by mere inspection of the mask. (lines 45-57 of col. 9)

However, this does not teach or suggest determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defect, as recited in the claimed invention. Cai merely mentions a plurality of rules, but does not disclose or imply that one rule is applied critical defects while a

different rule is applied to non-critical defects. That is, Cai makes no mention of how such a plurality of rules would be utilized in determining a final disposition of the component. Therefore, the applied references do not teach or suggest this feature.

Even assuming *arguendo* that Cai does teach the features lacking in Chang, which Applicants do not concede, there is no motivation to combine the references as suggested by the Examiner because Cai teaches away from the suggested combination. The above noted passage of Cai clearly teaches away from classifying the defects into critical defects and non-critical defects and using a plurality of design rules because of the time required for intensive computation. The Examiner even recognizes this in the outstanding Office Action. Instead, Cai discloses using the above-discussed single acceptance rule (i.e., the DSS) for all of the defects, regardless of their location on the mask. Thus, Cai expressly teaches away from the features that are lacking in Chang (i.e., classifying the defects into critical defects and non-critical defects, and determining a final disposition of the component by applying different acceptance rules to the critical defects and the non-critical defects). Therefore, there is no motivation to combine the references as suggested by the Examiner, and the rejection is improper and should be withdrawn.

Applicants submit that claims 2-6, 8-10, 12-15, 17, 18, and 20 each depend from an allowable independent claim, and are allowable by virtue of the allowability of the respective independent claims. Moreover, the applied reference do not teach or suggest many of the features of the dependent claims.

Accordingly, Applicants respectfully request that the rejection over claims 1-6, 8-20, and 36 be withdrawn.

Claim 7 in view of Chang, Cai, and Mansfield

The Examiner is of the opinion that it would have been obvious to the skilled artisan to combine the Chang, Cai, and Mansfield, and that the resulting combination shows all of the features of the claimed invention. Applicants respectfully disagree.

Claim 7 depends indirectly from allowable independent claim 1. As described above, Chang and Cai do not teach or suggest all of the features of claim 1. Mansfield does not compensate for the deficiencies of Chang and Cai with respect to claim 1. Therefore, no proper combination of the applied references teaches or suggests all of the features of the claimed invention.

Accordingly, Applicants respectfully request that the rejection over claim 7 be withdrawn.

New Claims

By this response, new Claims 37-46 are added and are believed to be patently distinct from the applied art and in condition for allowance. For example, claims 37-42 depend from an allowable independent claim, and are allowable at least for the reasons discussed above. Claims 43-46 recite features that are not taught or suggested by the applied art, including, *inter alia*, reading a first rule from a predetermined rule set of a plurality of rules and determining whether to repair, accept, or scrap the component based upon the defect by applying the first rule to the generated shape.


Other Matters

Claims 11 and 19 have been amended to correct grammatical errors that have come to Applicants' attention, and not for reasons related to patentability.

CONCLUSION

In view of the foregoing amendments and remarks, Applicants submit that all of the claims are patentably distinct from the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue. The Examiner is invited to contact the undersigned at the telephone number listed below, if needed. Applicants hereby make a written conditional petition for extension of time, if required. Please charge any deficiencies in fees and credit any overpayment of fees to Attorney's Deposit Account No. 09-0456.

Respectfully submitted,
James A. BRUCE

A handwritten signature in black ink, appearing to read 'Andrew M. Calderon', is written over a horizontal dashed line.

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